Hydrologic Model Manager

Short Name	UEB
Long Name	Utah Energy Balance Snowmelt Model
Description	
Model Type	Energy Balance Snowmelt Model
Model Objectives	The purpose of the model is the simulation of snowmelt surface water input rates, from meteorological data.
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Model Structure	The model uses a vertically lumped representation of the snowpack with two primary state variables, namely, water equivalence and energy content relative to a reference state of water in the ice phase at 0 C. This energy content is used to determine snowpack average temperature or liquid fraction. Snow surface age is retained as a third state variable, used for the calculation of albedo. The model is driven by inputs of air temperature, precipitation, wind speed, humidity and radiation at time steps sufficient to resolve the diurnal cycle (hourly to six hourly). The model uses physically-based calculations of radiative, sensible, latent and advective heat exchanges. Where radiation input is not available it is modeled based upon time of year/day and diurnal temperature range. An equilibrium parameterization of snow surface temperature accounts for differences between snow surface temperature and average snowpack temperature without having to introduce additional state variables. Melt outflow is a function of the liquid fraction, using Darcy's law. This allows the model to account for continued outflow even when the energy balance is negative.
Interception	
Groundwater	
Snowmelt	
Precipitation	
Evapo-transpiration	
Infiltration	

Model Paramters	The model is intended to be transportable, i.e. broadly applicable without the need for calibration of parameters. Use of a set of default parameters supplied with the model is recommended. The parameters consist of: snow surface aerodynamic roughness, snow surface heat conductance, snow saturated hydraulic conductivity, snow reflectance (albedo) in visible and near infrared bands, snow density, snow capillary retention fraction, snow emissivity, ground heat capacity and density, temperatures for partition of precipitation into rain and snow, depth of thermally active part of ground, bare ground albedo, air temperature and wind speed measurement height.
Spatial Scale	The model is a point model, but designed to be parsimonius so that it may be applied in a distributed fashion on a grid over a watershed.
Temporal Scale	Time steps need to be small enough to resolve the diurnal cycle, e.g. hourly or six hourly. Smaller time steps are possible, but inefficient and larger time steps result in degradation in model performance.
Input Requirements	The input data required consists of site variables describing the particular setting involved, and time series of input weather data to drive the model. Site variables required are: forest cover fraction, drift multiplier, atmospheric pressure (or elevation), ground heat flux, albedo extinction depth, slope, aspect (slope direction) latitude. Weather data required to drive the model consists of: Air temperature, precipitation, wind speed, relative humidity, incident solar radiation (optional), net radiation (optional). If radiation data are not supplied the daily temperature range is used to infer cloudiness which is then used to calculate radiation.
Computer Requirements	The model has successfully been run on UNIX workstations and Windows based PC's at speeds of 150 Mhz and higher.
Model Output	The model output consists of time series of snow water equivalence and energy content during the simulation period as well as snowmelt surface water inputs and energy fluxes to and from the snow.
Parameter Estimatn Model Calibrtn	A set of default parameters is supplied with the model. These were calibrated using data from the Central Sierra Snow Laboratory (CSSL). Further calibration by users is not necessary.
Model Testing Verification	The model, with parameters calibrated from CSSL data, has been tested against measurements in Utah and Idaho by the developers. The model has also been independently tested and used by others. The users manual includes results from tests by Harrington at the University of Arizona using data from Mammoth mountain.
Model Sensitivity	The most sensitive parameters in the model are: surface aerodynamic roughness, surface heat conductance, surface saturated hydraulic conductivity, albedo, depth of thermally active soil and drift factor. A comprehensive sensitivity analysis has not been published.
Model Reliabiity	The model has been found to reliably reproduce snow water equivalence and melt outflow measurements where it has been tested.
Model Application	The model has been used in several case studies. Papers describing some of these are given or referenced at http://www.engineering.usu.edu/dtarb/.
Documentation	A comprehensive technical description and users manual is available from http://www.engineering.usu.edu/dtarb/.
Other Comments	The model executable and source code is freely available from http://www.engineering.usu.edu/dtarb/.

Date of Submission	1/11/2000 9:54:52 AM
Developer	
Technical Contact	
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